

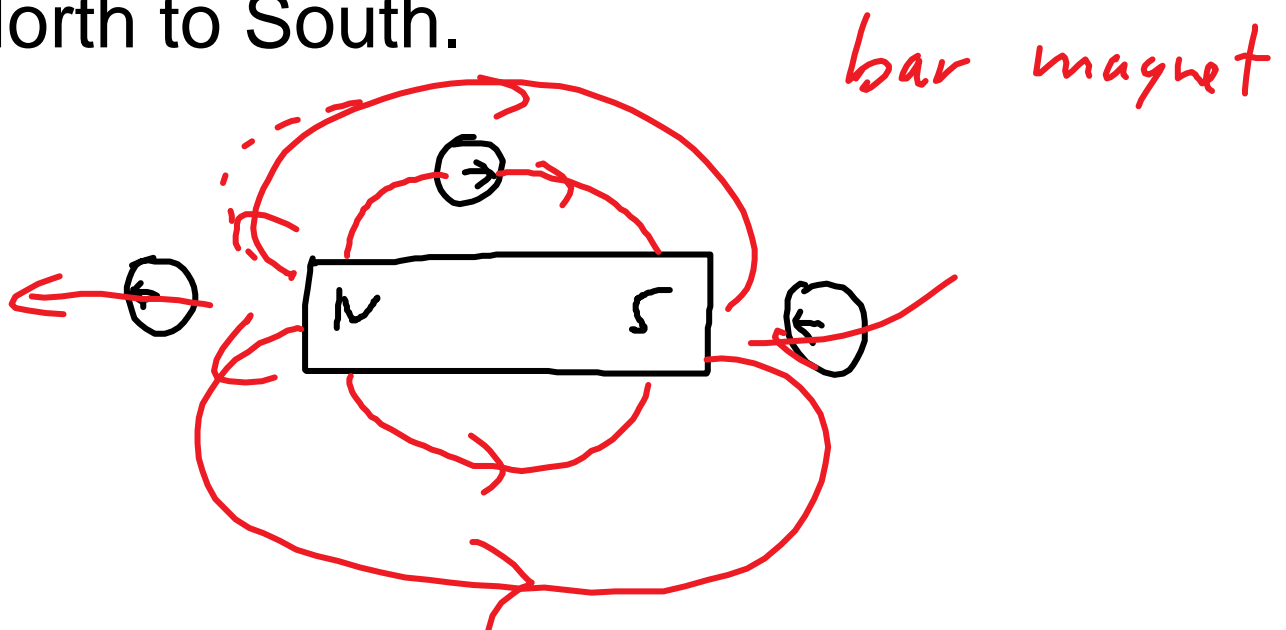
# Magnetism

What do you know about magnetism?

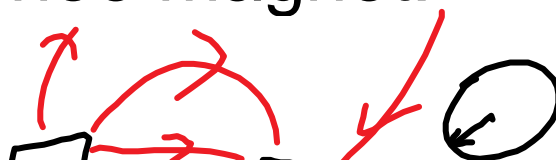
magnets have North and South poles  
opposites attract, like repel

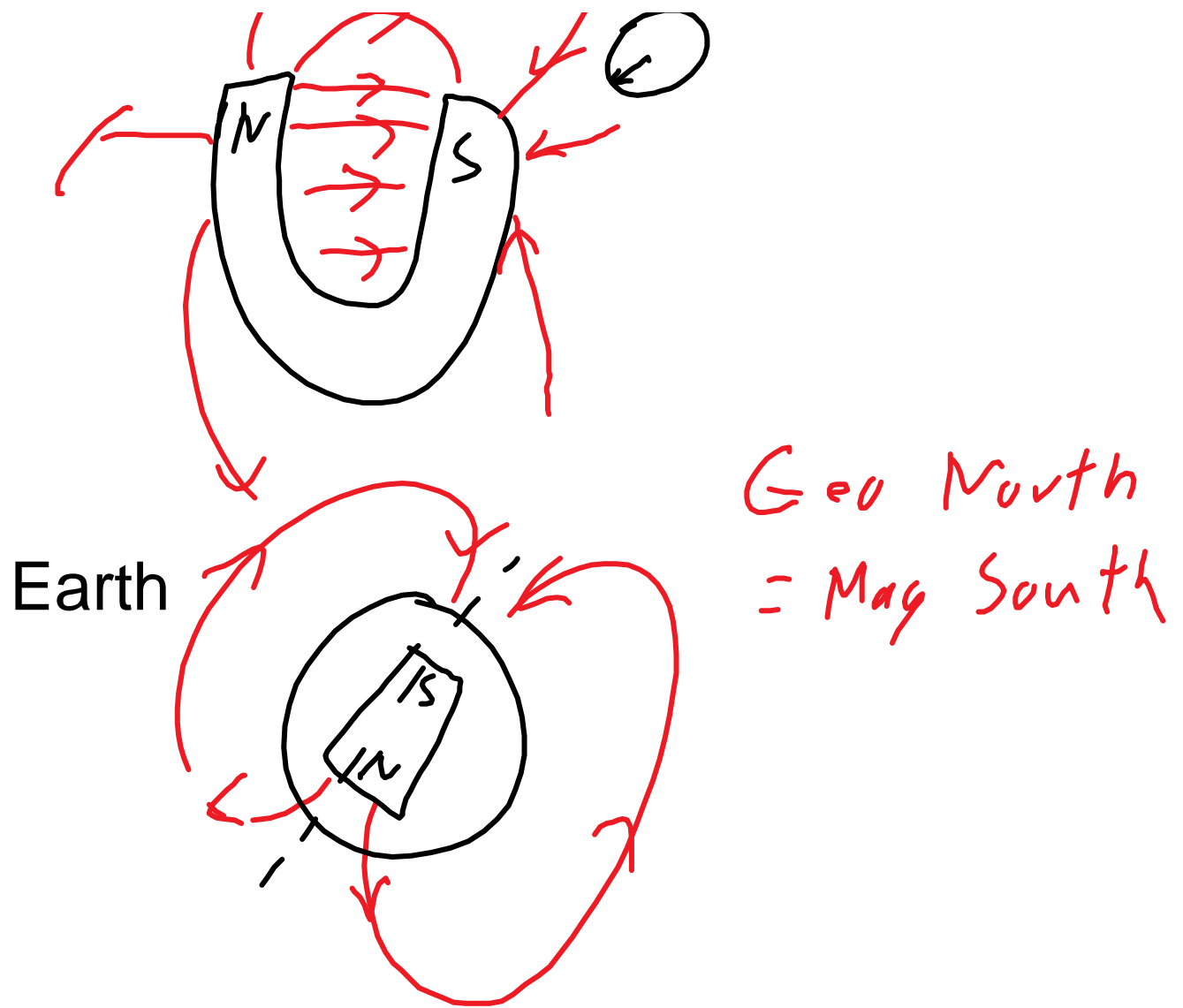
define the magnetic field,  $B$ , direction  
as the direction a compass points at  
that point.

Magnetic field lines therefore go from  
North to South.



Horseshoe magnet:

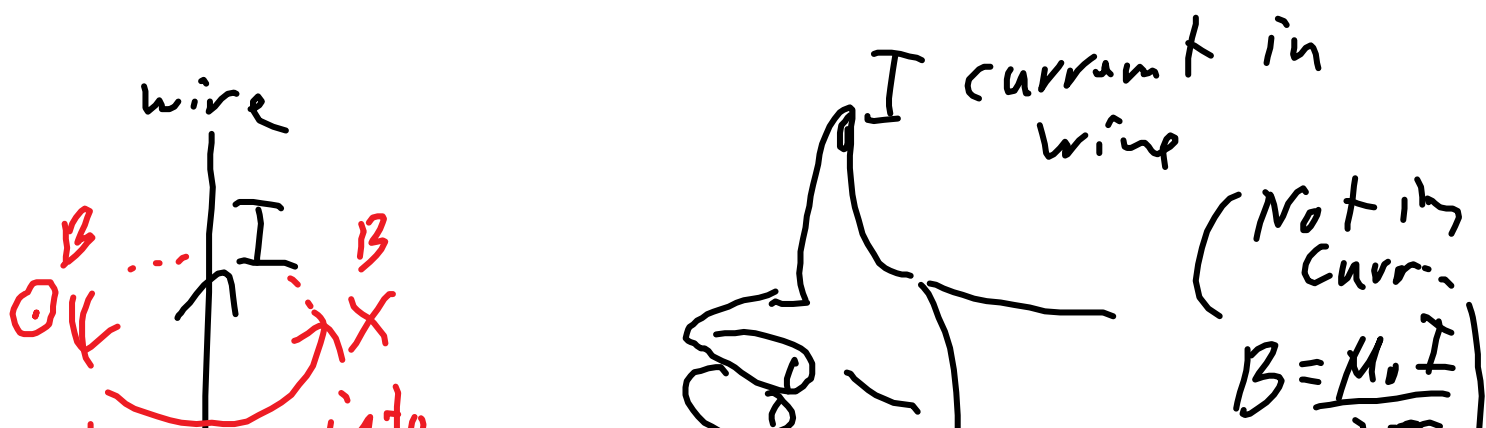


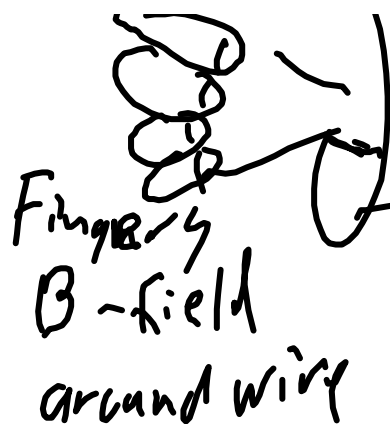
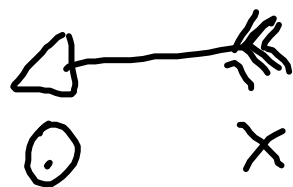
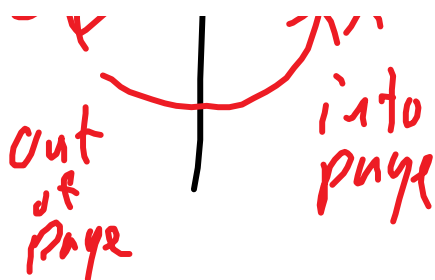


What causes magnetism?

moving charges create magnetic fields

First Right Hand Rule:





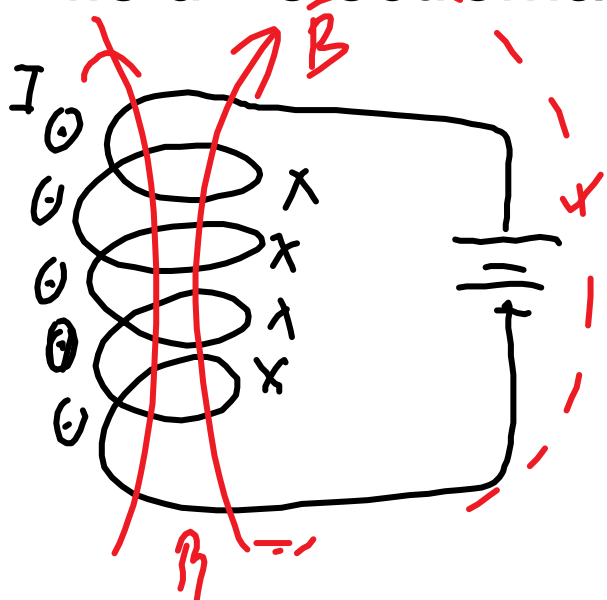
$$B = \frac{\mu_0 I}{2\pi r}$$

$$\mu_0 = 4\pi \times 10^{-7} \frac{Tm}{A}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$$

T is tesla, the unit for magnetic field strength  $T = N/Am$  or  $Ns/Cm$

Solenoid is a set of loops of wire used to create a strong, uniform magnetic field - electromagnet.



Fingers Current in loops, I

Not in curriculum -  $B = \mu_0 NI/L$

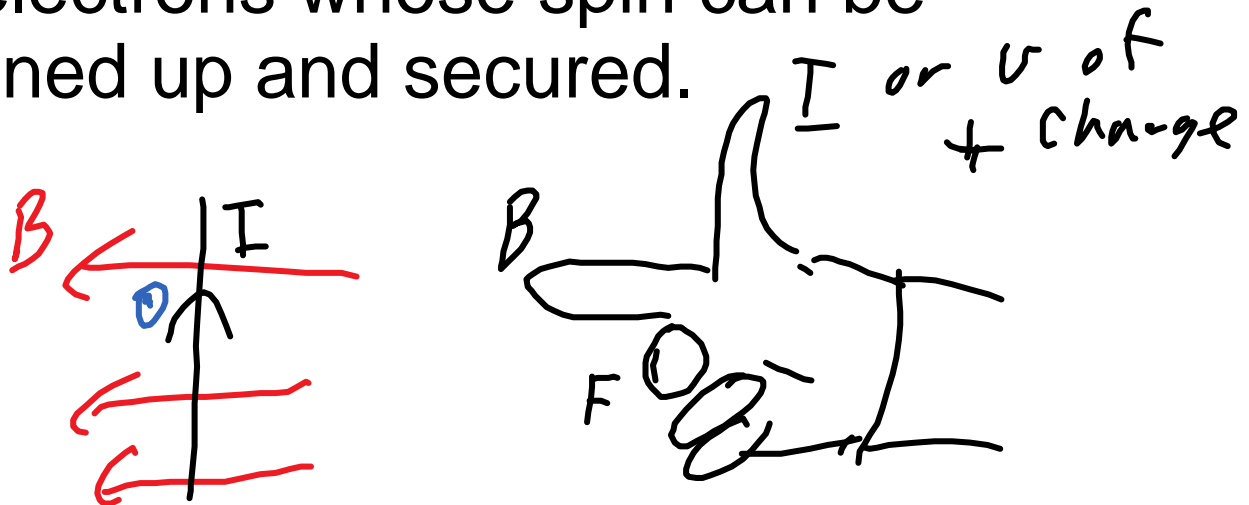
N is the number of coils

I is the current in the solenoid

L is the length of the solenoid

Magnetism is also caused by quantum spins lined up.

Some atoms, have outer electrons whose spin can be lined up and secured.



$F_B$  is the magnetic force on a wire or moving charge,  $q$

$I$  is the current in the wire

$B$  is the magnetic field strength, in T

$L$  is the length of the wire, in m, in the field.

$\theta$  is the angle between  $L$  and  $B$

$F_B = BIL\sin\theta$  (vector cross product of  $I$  and  $B$  - max when  $\theta=90^\circ$ )

When we bring the magnet near

the cathode ray tube, the electron beam is deflected up, why?

electron Beam out of the  
page



- Thumb shows  
v of + charge  
opposite negative